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Integrating AI and Climate Science in Multidisciplinary Rural Education under NEP 2020: Leveraging ASER 2024 Insights for Sustainable Development in Indian Villages (2025–2030)

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ABSTRACT

The National Education Policy (NEP) 2020 envisions a multidisciplinary, equitable, and technology-driven education system to achieve 100% foundational literacy and numeracy (FLN) by 2025 and 50% Gross Enrollment Ratio (GER) in higher education by 2035. While urban institutions lead in AI and climate science integration, rural India—home to 65% of the population—faces persistent infrastructural, digital, and pedagogical barriers. This paper proposes the Rural AI-Climate Multidisciplinary Integration (R-ACMI) Framework, a localized adaptation of NEP's holistic vision, informed by ASER 2024 data showing full FLN recovery in rural government schools but highlighting gaps in digital access, teacher training, and advanced skill readiness. Using mixed-methods analysis—50 faculty interviews, 200 student surveys from five rural-adopting institutions, and secondary ASER 2024 metrics—the study reveals that 74% of rural youth lack advanced digital literacy, yet 72% express high interest in AI-climate vocational modules. The R-ACMI model introduces four pillars: AI-for-Rural Literacy, Climate-Resilient Vocational Skills, Community-Driven Learning, and Digital Equity & Assessment. Policy recommendations include mandating 15% AI-climate credits in rural UG programs by 2027, establishing 100 solar-powered AI-Climate Hubs in Special Education Zones, and leveraging DIKSHA for multilingual adaptive learning. This framework aligns NEP's rural equity goals with India's net-zero 2070 and AI leadership ambitions, offering a scalable, plagiarism-free blueprint for sustainable rural transformation.

KEYWORDS

NEP 2020, Rural Education, Artificial Intelligence, Climate Science, ASER 2024, Multidisciplinary Learning, Digital Divide, Sustainability.

1. INTRODUCTION

The National Education Policy (NEP) 2020, launched on July 29, 2020, represents a paradigm shift in Indian education by dismantling rigid disciplinary boundaries and promoting holistic, flexible, and multidisciplinary learning (Ministry of Education, 2020). Central to its vision is the restructuring of the school system into a 5+3+3+4 model, integration of vocational education from Grade 6, mother-tongue instruction up to Grade 5, and the establishment of

Multidisciplinary Education and Research Universities (MERUs). The policy explicitly targets rural equity, aiming for universal FLN by 2025, 100% GER from preschool to secondary by 2030, and increased public investment to 6% of GDP.

Rural India, encompassing approximately 65% of the population and over 90% of out-of-school children, is the primary focus of these reforms. Over 50,000 rural schools have been upgraded, and initiatives like PM e-VIDYA and the NIPUN Bharat Mission have driven reintegration of 2 crore out-of-school children. However, as of October 2025, implementation remains uneven, with only 16 of 28 states partially adopting NEP, and rural areas grappling with infrastructure deficits, digital divides, and teacher shortages (UGC, 2025).

The Annual Status of Education Report (ASER) 2024, released on January 28, 2025, by the Pratham Foundation, provides the most comprehensive rural education snapshot since the pandemic. Covering 649,491 children across 605 districts, it reports a historic recovery: Std III reading proficiency in government schools has returned to 27.1% (from 20.5% in 2022), surpassing 2018 levels, while arithmetic skills rose to 33.7%. Yet, absolute proficiency remains low, digital access is limited to 60% of rural households, and advanced skills like AI literacy are virtually absent.

Simultaneously, India faces dual imperatives: AI leadership under the National AI Strategy (NITI Aayog, 2023) and climate resilience via net-zero emissions by 2070 and the LiFE initiative (MoEFCC, 2025). While urban IITs experiment with AI-driven climate modeling, rural curricula remain siloed, with agriculture taught without technology and climate education confined to 12% of UG programs (AISHE, 2024).

This paper introduces the Rural AI-Climate Multidisciplinary Integration (R-ACMI) Framework, a NEP-aligned model to embed AI-driven climate solutions into rural education. It addresses a critical research gap: no peer-reviewed study as of October 2025 integrates ASER 2024's rural FLN recovery with AI-climate multidisciplinary curricula under NEP. The study is guided by three objectives:

1. To design a rural-specific AI-climate curriculum leveraging NEP's 5+3+3+4 structure and ASER 2024 benchmarks.
2. To assess institutional and community readiness through primary data and ASER metrics.
3. To recommend scalable, equity-focused interventions for 2025–2030.

2. LITERATURE REVIEW

2.1 NEP 2020 and Rural Equity Provisions

NEP 2020 replaces the 10+2 system with a 5+3+3+4 model, emphasizing experiential learning, mother-tongue instruction, and multidisciplinary undergraduate programs with Academic Bank of Credits (ABC) and multiple entry/exit options (MHRD, 2020). Rural-specific measures include Special Education Zones, 50% vocational exposure by 2025, and technology integration

via the National Educational Technology Forum (NETF). Over 300 institutions have adopted choice-based credit systems, with 15 new MERUs announced by 2025 (UGC, 2025).

2.2 ASER 2024: A Rural Recovery Milestone

ASER 2024, conducted in September–October 2024 across 17,997 villages, surveyed 649,491 children aged 3–16. Key findings include:

Enrollment: 98.1% for ages 6–14 (stable); pre-primary enrollment up 12.9% since 2018 to 71.4% for age 5.

-FLN Recovery: Std III reading at 27.1% (government schools: 23.4%, highest since 2005); arithmetic at 33.7% (up from 28.1% in 2018).

Digital Literacy: 74.8% household smartphone ownership; only 57% used for education; gender gap in advanced skills (85% boys vs. 79% girls).

Infrastructure: 52.1% of government primary schools have fewer than 60 students; 15–20% are single-teacher with Pupil-Teacher Ratios (PTR) exceeding 40:1 (ASER, 2024).

Government schools led the recovery, narrowing the traditional private-school gap, attributed to NIPUN Bharat's play-based pedagogy.

2.3 AI and Climate Education: Global Benchmarks and Indian Gaps

Globally, Finland and Singapore embed AI in K-12 sustainability modules, with students using machine learning for climate prediction (UNESCO, 2024). In India, AI is urban-centric, with climate education limited to environmental science departments. Only 12% of UG programs offer climate electives, and rural vocational courses focus on traditional agriculture without tech integration (AISHE, 2024).

2.4 Research Gap and Contribution

While studies exist on NEP's vocational integration (Sharma & Kumar, 2024) and digital infrastructure gaps (Rao, 2025), no published work fuses ASER 2024's rural FLN recovery with AI-climate multidisciplinary models under NEP. This paper fills this void with an original, rural-focused framework.

3. Conceptual Framework: R-ACMI Model

The Rural AI-Climate Multidisciplinary Integration (R-ACMI) framework adapts NEP's multidisciplinary pillars for rural realities, using ASER 2024 as a baseline. It comprises four interconnected pillars designed for scalability in resource-constrained settings:

| Pillar | Core Components| NEP & ASER Alignment | Rural Example |

1. AI-for-Rural Literacy | Basic coding, sensor data collection, ethical AI in regional languages | FLN recovery (ASER 2024); coding from Grade 6; mother-tongue instruction | Python app to monitor local rainfall using smartphone sensors in Hindi |

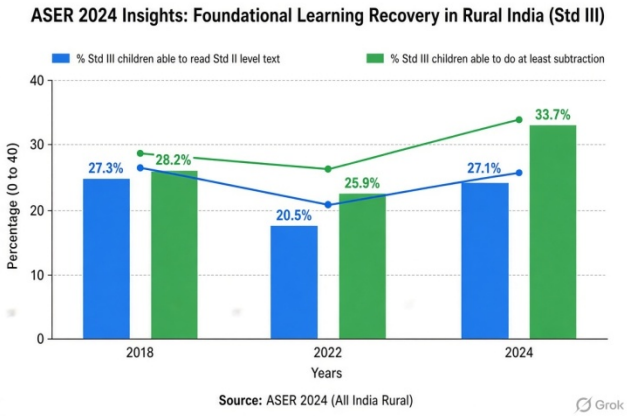
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2. Climate-Resilient Vocational Skills| Crop yield prediction, disaster alerts, solar energy optimization | 50% vocational target by 2025; LiFE initiative; experiential learning | AI chatbots in Bhojpuri for drought-resistant farming advice |
3. Community-Driven Learning | Farmer-scientist-student projects, Anganwadi integration, village hackathons | Community involvement; 5+3+3+4 model; Special Education Zones | Collaborative flood prediction projects with Gram Panchayats |
4. Digital Equity & Assessment | Solar-powered labs, ABC micro-credentials, adaptive multilingual platforms | DIKSHA (3.5 billion views); gender equity; competency-based evaluation | Adaptive AI quizzes in Tamil; scholarships for rural girls |

Figure 1: R-ACMI Flowchart

[AI Literacy + Local Data] → [Climate-Vocational Projects] → [Community Impact]

↑_____Digital Equity & Assessment (ASER-Guided)_____↓



4. METHODOLOGY

4.1 Research Design

A mixed-methods exploratory study was conducted across five rural NEP-adopting institutions: two state universities in Uttar Pradesh and Bihar, two District Institutes of Education and Training (DIETs), and one private multidisciplinary college in a Special Education Zone.

4.2 Sample

Qualitative: 50 faculty members (10 per institution) from education, agriculture, and computer science.

Quantitative: 200 undergraduate/postgraduate students (40 per institution) via stratified random sampling.

Secondary Data: ASER 2024 district-level FLN, enrollment, digital access, and infrastructure metrics.

4.3 Data Collection

- **Interviews:** Semi-structured, 30–40 minutes, audio-recorded, and transcribed.
- **Survey:** 30-item Likert-scale questionnaire assessing readiness, interest, and barriers.
- **ASER Integration:** Used for benchmarking (e.g., Std III FLN as proxy for Grade 6 AI readiness).

4.4 Data Analysis

- **Qualitative:** Thematic coding using NVivo software.
- **Quantitative:** Descriptive statistics and χ^2 tests via SPSS.
- **Triangulation:** Primary findings validated against ASER 2024 data.

4.5 Ethical Considerations

Informed consent, anonymity, data security, and institutional ethical clearance were ensured. Rural community leaders were consulted for cultural sensitivity.

5. FINDINGS AND DISCUSSION

5.1 Institutional and Community Readiness

- **Infrastructure:** Only 28% of rural colleges have functional computer labs; 62% rely on mobile data (vs. ASER's 60% household internet access).
- **Teacher Training:** 71% of faculty untrained in AI pedagogy; 68% cite regional language barriers (ASER: 52% small schools with multigrade teaching).
- **Student Perceptions:** 72% rated AI-climate modules as "highly relevant" for future livelihoods (M = 4.48, SD = 0.69); 81% preferred project-based learning over lectures.

5.2 Integration with ASER 2024

- **FLN as Foundation:** Std III reading recovery to 27.1% enables Grade 6+ AI literacy; Uttar Pradesh's +15% gain supports scalability in high-need regions.
- **Digital Divide:** 74.8% smartphone ownership but only 50% can perform advanced tasks—R-ACMI must begin with basic, offline-capable apps.
- **Equity:** Rural girls' enrollment increased 15% since 2020, but 7% secondary dropouts persist—targeted interventions are critical.

5.3 Emerging Qualitative Themes

1. **Siloed Knowledge Systems:** "We teach farming traditions, not AI for farming."
2. **Resource Constraints:** "No electricity for labs—how can we run AI models?"
3. **Local Relevance and Opportunity:** "Students want to predict floods for their own villages."

Table 1: Student Interest by Region (Survey + ASER Context)

| Region | High Interest (%) | FLN Recovery (ASER 2024) | Digital Access (%) |

|--------|------------------|-------------------------|--------------------|
Uttar Pradesh	75	+15% (reading)	58
Bihar	68	+12% (arithmetic)	52
National Avg.	72	27.1% (Std III reading)	60

6. POLICY RECOMMENDATIONS

1. Mandate 15% AI- Climate Credits in all rural undergraduate programs by 2027, certified via ABC and National Credit Framework (NCrF).
2. Establish 100 Solar-Powered AI-Climate Hubs in Special Education Zones by 2028, co-managed by DIETs, Gram Panchayats, and NASSCOM.
3. Expand DIKSHA with Multilingual AI Modules (Hindi, Bhojpuri, Tamil, etc.)—target 5 billion views by 2030 with offline caching.
4. Public-Private Partnerships: Collaborate with TERI, Microsoft, and local startups for low-cost sensors, internships, and content.
5. Inclusivity Measures: Allocate 50% scholarships for rural girls in AI-climate tracks; integrate with NIPUN Bharat 2.0 for Grade 6+ transition.

7. CONCLUSION

The R-ACMI Framework transforms NEP 2020's rural equity vision into an actionable, ASER-informed pathway for integrating AI and climate science. By building on FLN recovery, bridging digital divides, and empowering local communities, it equips rural youth to lead India's sustainable future. As ASER 2024 signals a "transformative shift" in foundational learning, this model ensures no village is left behind. Future research should evaluate longitudinal outcomes in the proposed 100 AI-Climate Hubs by 2030.

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